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Performance Analysis of Stable Election Protocol in Wireless Networks

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***Abstract*: Wireless sensor network is becoming a major research area in wireless communication. Wireless sensor networks include clustering techniques to extend the life of the network. The clustering process in the wireless sensor network is connected to the energy control. There are different protocols that use the concept of clustering like LEACH, SEP, HEED, DEEC etc. In this project, clustering based routing protocols LEACH (Low Energy Adaptive Clustering Hierarchy Protocol) and SEP (Stable Election Protocol) have been studied and found that the SEP creates more stable routing environment than LEACH. Wireless sensing element network is take issue from alternative networks in terms of optimization of quantity of energy as a result of once these sensors sense and transmit knowledge to alternative sensors gift within the network, goodish quantity of energy is dissipated. varied routing algorithms square measure planned to limit the powers utilized by the wireless sensors. during this thesis, we'll Execute this "Stable Election Protocol" in terms of packet transmission, energy dissipation and range of nodes alive and stability amount and that we can discuss the advantage and disadvantage of this protocol below varied conditions. "SEP square measure already best better-known for maintaining energy efficiency" Wireless Sensing Element Network (WSN) provides several benefits like movability, flexibility, exaggerated productivity, deplorability, quality and lower installation prices. Wireless device Networks (WSNs) square measure distributed network of all small and light weight weighted nodes which may sense physical parameters like temperature, pressure, ratio. wireless sensing element Networks (WSNs) contain an oversized variety of sensing element nodes that sense the setting they, are used in; and gather the information and forward it to the bottom Station (BS). The sensing and transmission of knowledge involves an enormous quantity of energy. Whereas WSNs area unit equipped to handle advanced functionalities, the network processing could need the sensors to use the strained energy to boost the network lifespan. Many protocols are projected for achieving energy potency in heterogeneous structure of the network.**

***Keywords*: wireless networks**

1. Introduction

In the last two decades, wireless sensor network plays an important role in day to day life. It is the unique technology which has many commercial and industrial applications1,2. There is a group of spatially dispersed and dedicated sensor nodes which measures environmental conditions such as temperature, pressure, humidity, pollution levels, wind etc. All the sensor nodes are responsible for collecting, distributing and processing information in various application areas. During the sensing and transmission of data, some amounts of energy are consumed. Energy consumption is the major problem in wireless sensor networks because each sensor node is powered by battery and it is not possible to recharge or replace batteries once they have deployed the network. Therefore, energy efficient routing protocol should be design for the maximization of network lifetime. Clustering is an effective method used to reduce energy consumption3. Clustering based routing protocols are of two types- homogeneous and heterogeneous. In wireless sensor networks, sensor nodes are not always homogeneous, they can be heterogeneous. Protocols like LEACH (Low Energy Adaptive Clustering Hierarchy Protocol), HEED (Hybrid Energy Efficient Distributed clustering) are suitable for homogeneous network but they cannot perform well in the heterogeneous network. In order to improve efficiency of wireless sensor networks, advanced protocols like SEP (Stable Election Protocol), ECRSEP (Energy Consumption Rate based Stable Election Protocol) are designed for heterogeneous networks4,5. They can also be used in homogeneous environments. The present investigation deals with the performance analysis of SEP (Stable Election Protocol) in wireless sensor networks.

2. Leach protocol (Low Energy Adaptive Clustering Hierarchy Protocol)

Low Energy Adaptive Clustering Hierarchy Protocol is the first Hierarchical routing protocol which was proposed by Dr. W. R. Heinzelman. LEACH Protocol is based on the concept of clustering in which it selects the cluster head randomly. The cluster heads compresses aggregate data and transmits it to base station.

If the node is selected as a cluster head, it cannot be a cluster head again as long as all the nodes of the cluster do not become cluster heads once (i.e. For balancing energy consumption, there is an equal chance of becoming a cluster head in each node). For a specific round, node n generates a random number between 0 and 1. If the generated number is less than the threshold (T), then the node becomes a cluster head. Threshold T(n) can be expressed as follows,

$$T(n) = \begin{cases} \dfrac{P}{1 - P \cdot r \cdot \mathrm{mod} \frac{1}{P}} & If\ n \in G \\ 0 & otherwise \end{cases} \quad (1)$$

Where,

n= Number of nodes in the network

P= Probability to become a cluster head r= Current round

G= Set of nodes which have not been cluster head in previous 1/P rounds

The communications between non-cluster head nodes with the cluster head in a TDMA (Time – Division Multiple Access) fashion6. LEACH uses randomization to distribute energy resources among all the nodes and improved the network lifetime. But due to homogeneous network (Nodes of the sensor network have same amount of energy), it gives poor performance in heterogeneous wireless sensor networks and not suitable for large areas.

SEP (Stable Election Protocol):

Stable election protocol is a heterogeneous protocol (Nodes have different energy) in wireless sensor networks that increases stability region of sensor nodes and reduces energy consumption.

SEP (heterogeneous protocol) is an improvement over LEACH protocol (homogeneous protocol). Due to heterogeneity in SEP, nodes have different energy. The nodes with lower energy are called normal nodes and the nodes which have higher energy are called advanced nodes. High energy advanced nodes has higher probability to become a cluster head. The equations for probability to select cluster heads are as follows,

$$P_{nrm} = \frac{P_{opt}}{1 + \alpha m} \quad (2)$$

$$P_{adv} = \frac{P_{opt}}{1 + \alpha m}(1 + \alpha) \quad (3)$$

Where,

m= Fraction of advanced nodes

α = Energy factor between advanced and normal nodes

Popt= The optimal probability of each node to become cluster head Threshold for normal and advanced node can be expressed as follows,

$$T(S_{nrm}) = \begin{cases} \dfrac{P_{nrm}}{1 - P_{nrm}[r \cdot \mathrm{mod}(1/P_{nrm})]} & If\ S_{nrm} \in G' \\ 0 & otherwise \end{cases} \quad (4)$$

$$T(S_{adv}) = \begin{cases} \dfrac{P_{adv}}{1 - P_{adv}[r \cdot \mathrm{mod}(1/P_{adv})]} & If\ S_{adv} \in G'' \\ 0 & otherwise \end{cases} \quad (5)$$

Where, G'= Set of normal nodes which have not been cluster head in previous 1/Pnrm rounds G''=Set of advanced nodes which have not been cluster head in previous 1/Padv rounds from equations (2) and (3), it is clear that high energy advanced nodes have more probability to become a cluster head. Therefore, SEP provides better network lifetime with more stability due to advanced nodes. Smaragdakis et al 7 have studied SEP for clustered heterogeneous wireless sensor networks and proposed that stable region in SEP is increased significantly (by 26%) in comparison with that of LEACH. Joshi et al 8 has evaluated the performance of LEACH and SEP using MATLAB. Results show that SEP performs better than LEACH.

3. Research objective

This thesis lights on adaptive power conservation and optimization in the wireless sensors networks. Hence, the wireless sensor mainly depended on its power source/ battery, the energy and power consumption is very crucial in such applications/use.

The energy flow of the wireless network must be balanced in order to get symmetrical energy dispatch in the final transfer period. This research and development work focuses on determining the power losses in all sensors approximately equals. This is performed by balancing the transfer and implementing new clustering technique.

4. Proposed methodology

A. *System proposed*

General mode of the Energy Efficient Clustering Algorithm "EECA" adaptive software system is shown in fig. 6.1. In this dissertation firstly collect network data collection, it includes the calculation, find out the energy of each sensor and the beginning nodes clustering (distributing on the cells) over the measurement space and initialization.

The initialization is plotting the location of every sensor in measurement space and applying (FCM) traditional clustering algorithm to get the starting location of the head of each cluster. After receiving the number of clusters that is require to be used for cells from the base station. The next is to start the EECA clustering procedure, which is continue overall running period of the network. During this mode, the network is re-clustered every transfer time and re-localizes a new head of cluster and new distribution of nodes (sensors) in the cells (clusters). When the nodes start to die, the base station should stop collecting data from the network and generates the decision and command to replace the sensors.

General scheme of the adaptive EECA is being illustrated in Figure 1, and the details will be described as following; the process starts by data collection from the network. Then, the initial fuzzy clustering algorithm FCM is applied. After that, the normal running mode is entered, it consists of two phases those are consequent. The first is adaptive clustering which is

described in details and the second is data transfer. This is still running until the network becomes idle, either by nodes death or by the base station commands.

It is summarized as following; the process starts by data collection from the network. Then traditional clustering is applied at startup which means that the cluster head is going to be fixed forever. A normal running mode is entered, it consists of only data transfer and this is still running until the network becomes idle, either by nodes death or by the base station commands.

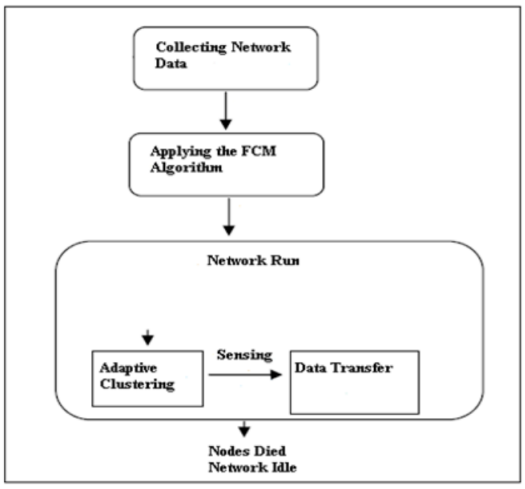

Fig. 1. Shows that Basic Block Diagram of the EECA System

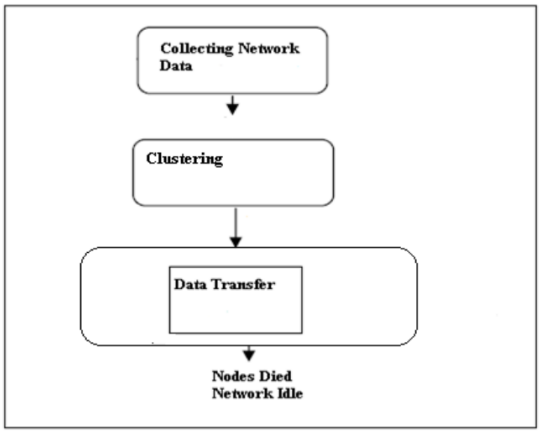

Fig. 2. Shows that Traditional LEACH Algorithm

B. Clustering

Nodes grouping in clusters (cells) are the core of the LEACH protocol and its addition (i.e. LEACH-M, LEACH-L). In general, classification a set of points (nodes) into cells or clusters is focused in modern applications and researches, mainly, in networking and innovative of the networks.

The classification a bulk of nodes into clusters is highly dependent on the deployment specifications, system's architecture, scheme of bootstrapping, cluster characteristics, etc. The center of the cluster is basically known as Head of Cluster "CH". The head of cluster is one of the cluster's nodes. The number of nodes in one cluster is almost differs from it in the other clusters. Where the head of cluster can form in some systems a second tier of the network and thus, another hieratical level can be formed, or it may be just the data to another point the clustering in theory has many advantages in addition to the network scalability support. Also, it minimized the routing table's size that stored at individual nodes, and allows to safe the bandwidth of the communication because it limits the cluster interactions scope to the head of clusters, the redundancy avoiding would result and change among nodes is being enabled.

Figure 3, shows a sample of bulk data clustering in the left, and that is being clustered in the right side. The Figure shows two dimensional distributed nodes, then, it classified into four clusters. Each cluster is colored with unique color.

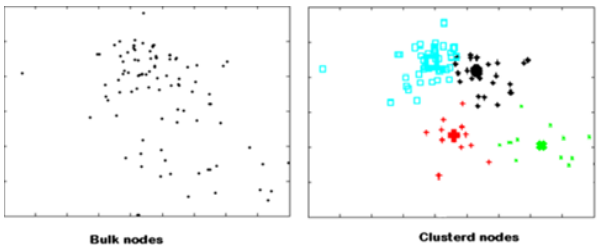

Fig. 3. Shows that Sample of data clustering

Different methodologies are being used in data clustering, such as TECH SEP, EAMMH etc. In wireless sensors network, the clustering process separate the nodes of changes at the tier of inter-cluster heads level, thus, reducing the preserving topology overhead. Optimized techniques can be apply by the head of cluster in order to increase the operation of the network and increased the battery life of the nodes. So, the heads of clusters record the overall activity of the clusters, thus, the nodes handle the sleep modes at the most of the time. That minimizes the consumption of energy.

To reduce or even remove the sacking of the data in the clusters, the use of data gathering or homogeneous techniques is being taken a place. In addition, the clustering raises the connectivity of nodes to the head of cluster and center all cluster nodes on the cluster head. This minimizes the delay of measurement transfer and communicating to the base station. It comprises the maximum network longevity.

5. Conclusion and future work

In this project, cluster based routing protocols LEACH (homogeneous protocol) and SEP (heterogeneous protocol) have been studied and found that SEP provides better network lifetime and creates more stable routing environment than LEACH.

This research concerns to implement a new methodology for wireless sensors adaptive clustering in order to optimize energy and power consumption in the network. Many researches in past and current data systems world are regarding within the energy optimization. The optimization of wireless network energy researches either considerations on hardware

modification and optimization or either code management. The energy of wireless sensor networks is important issue and needs more hardware and software solutions to get good optimization methods.

Energy optimization will considerably be done by an appropriate cluster algorithmic rule. This research is a novel clustering algorithm for improving the conservation of energy in WSN's. Hence, the asymmetry of clusters (cells), the nodes will consume asymmetrical power, due to the asymmetrical structure, design, and pocket data transfer.

While, it can be managed to balance the cluster's load by introducing a specific variable or concept that can express the overall load of the cluster and also node. Whereas this variable or concept should be mathematically and physically meaningful for all conditions and variables that affect the sensors battery and cluster communication transfer. This variable or conception is thus known as during this thesis "POTENTIAL."

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